

$$\text{FEL}_{\text{max,HC+NO}_x} = 6.0 + 0.25 \cdot \left( 151 + \frac{557}{P^{0.9}} \right)$$

(2) For engines with maximum engine power above 40 kW, the maximum value of the family emission limit for CO is 450 g/kW-hr. For all other engines, the maximum value is defined by the following formula, with results rounded to the nearest g/kW-hr:

$$\text{FEL}_{\text{max,CO}} = 650 - 5.0 \times P$$

(c) *Not-to-exceed emission standards.* Exhaust emissions may not exceed the not-to-exceed standards specified in § 1045.107.

(d) *Fuel types.* The exhaust emission standards in this section apply for engines using the fuel type on which the engines in the engine family are designed to operate. You must meet the numerical emission standards for hydrocarbons in this section based on the following types of hydrocarbon emissions for engines powered by the following fuels:

(1) Alcohol-fueled engines: THCE emissions.

(2) Natural gas-fueled engines: NMHC emissions.

(3) Other engines: THC emissions.

(e) *Useful life.* Your engines must meet the exhaust emission standards in paragraphs (a) through (c) of this section over the full useful life as follows:

(1) For outboard engines, the minimum useful life is 350 hours of engine operation or 10 years, whichever comes first.

(2) For personal watercraft engines, the minimum useful life is 350 hours of engine operation or 5 years, whichever comes first.

(3) You must specify a longer useful life in terms of hours for the engine family if the average service life of your vehicles is longer than the minimum value, as follows:

(i) Except as allowed by paragraph (e)(3)(ii) of this section, your useful life (in hours) may not be less than either of the following:

(A) Your projected operating life from advertisements or other marketing materials for any engines in the engine family.

(B) Your basic mechanical warranty for any engines in the engine family.

(ii) Your useful life may be based on the average service life of vehicles in the engine family if you show that the average service life is less than the useful life required by paragraph (e)(3)(i) of this section, but more than the minimum useful life (350 hours of engine operation). In determining the actual average service life of vehicles in an engine family, we will consider all available information and analyses. Survey data is allowed but not required to make this showing.

(f) *Applicability for testing.* The duty-cycle emission standards in this subpart apply to all testing performed according to the procedures in § 1045.505, including certification, production-line, and in-use testing. The not-to-exceed standards apply for all testing performed according to the procedures of subpart F of this part.

[73 FR 59194, Oct. 8, 2008, as amended at 75 FR 23019, Apr. 30, 2010]

#### § 1045.105 What exhaust emission standards must my sterndrive/inboard engines meet?

(a) *Duty-cycle emission standards.* Starting in the 2010 model year, exhaust emissions from your sterndrive/inboard engines may not exceed emission standards as follows:

(1) Measure emissions using the applicable steady-state test procedures described in subpart F of this part.

(2) For conventional sterndrive/inboard engines, the HC+NO<sub>x</sub> emission standard is 5.0 g/kW-hr and the CO emission standard is 75.0 g/kW-hr.

(3) The exhaust emission standards from the following table apply for high-performance engines:

TABLE 1 TO § 1045.105—EMISSION STANDARDS FOR HIGH-PERFORMANCE ENGINES (g/kW-hr)

Model year	Power <sup>1</sup>	HC+NO <sub>x</sub>	CO
2010 .....	P≤485 kW .....	20.0	350
	P>485 kW .....	25.0	350

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TABLE 1 TO § 1045.105—EMISSION STANDARDS FOR HIGH-PERFORMANCE ENGINES (g/kW-hr)—Continued

Model year	Power <sup>1</sup>	HC+NO <sub>x</sub>	CO
2011+ .....	P≤485 kW .....	16.0	350
	P>485 kW .....	22.0	350

<sup>1</sup> Power (P) = maximum engine power in kilowatts (kW).

(b) *Averaging, banking, and trading.* You may not generate or use emission credits for high-performance engines. You may generate or use emission credits under the averaging, banking, and trading (ABT) program described in subpart H of this part for demonstrating compliance with HC+NO<sub>x</sub> and CO emission standards for conventional sterndrive-inboard engines. To generate or use emission credits, you must specify a family emission limit for each pollutant you include in the ABT program for each engine family. These family emission limits serve as the emission standards for the engine family with respect to all required testing instead of the standards specified in this section. An engine family meets emission standards even if its family emission limit is higher than the standard, as long as you show that the whole averaging set of applicable engine families meets the emission standards using emission credits and the engines within the family meet the family emission limit. Family emission limits for conventional sterndrive/inboard engines may not be higher than 16.0 g/kW-hr for HC+NO<sub>x</sub> and 150 g/kW-hr for CO except as specified in § 1045.145(c).

(c) *Not-to-exceed emission standards.* Exhaust emissions may not exceed the not-to-exceed standards specified in § 1045.107 for conventional sterndrive/inboard engines. These standards do not apply for high-performance engines.

(d) *Fuel types.* The exhaust emission standards in this section apply for engines using the fuel type on which the engines in the engine family are designed to operate. You must meet the numerical emission standards for hydrocarbons in this section based on the following types of hydrocarbon emissions for engines powered by the following fuels:

(1) Alcohol-fueled engines: THCE emissions.

(2) Natural gas-fueled engines: NMHC emissions.

(3) Other engines: THC emissions.

(e) *Useful life.* Your engines must meet the exhaust emission standards in paragraphs (a) through (c) of this section over their full useful life, as follows:

(1) For high-performance engines with maximum engine power above 485 kW, the useful life is 50 hours of operation or 1 year, whichever comes first. For high-performance engines with maximum engine power at or below 485 kW, the useful life is 150 hours of operation or 3 years, whichever comes first.

(2) For conventional sterndrive/inboard engines, the minimum useful life is 480 hours of operation or ten years, whichever comes first. However, you may request in your application for certification that we approve a shorter useful life for an engine family. We may approve a shorter useful life, in hours of engine operation but not in years, if we determine that these engines will rarely operate longer than the shorter useful life. If engines identical to those in the engine family have already been produced and are in use, your demonstration must include documentation from such in-use engines. In other cases, your demonstration must include an engineering analysis of information equivalent to such in-use data, such as data from research engines or similar engine models that are already in production. Your demonstration must also include any overhaul interval that you recommend, any mechanical warranty that you offer for the engine or its components, and any relevant customer design specifications. Your demonstration may include any other relevant information. The useful life value may not be shorter than any of the following:

(i) 150 hours of operation.

(ii) Your recommended overhaul interval.

(iii) Your mechanical warranty for the engine.

(3) You must specify a longer useful life for conventional sterndrive/inboard engines in terms of hours if the average service life of engines from the engine family is longer than the minimum useful life value, as follows:

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(i) Except as allowed by paragraph (e)(3)(ii) of this section, your useful life (in hours) may not be less than either of the following:

(A) Your projected operating life from advertisements or other marketing materials for any engines in the engine family.

(B) Your basic mechanical warranty for any engines in the engine family.

(ii) Your useful life may be based on the average service life of engines in the engine family if you show that the average service life is less than the useful life required by paragraph (e)(3)(i) of this section, but more than the minimum useful life (480 hours of engine operation). In determining the actual average service life of engines in an engine family, we will consider all available information and analyses. Survey data is allowed but not required to make this showing.

(f) *Applicability for testing.* The duty-cycle emission standards in this section apply to all testing performed according to the procedures in §1045.505, including certification, production-line, and in-use testing. The not-to-exceed standards apply for all testing performed according to the procedures of subpart F of this part.

### § 1045.107 What are the not-to-exceed emission standards?

Not-to-exceed emission standards apply as follows:

(a) Measure emissions using the not-to-exceed procedures in subpart F of this part:

(b) Determine the not-to-exceed standard, rounded to the same number of decimal places as the emission standard in Table 1 to this section from the following equation:

$$\text{Not-to-exceed standard} = (\text{STD}) \times (\text{M})$$

Where:

STD = The standard specified in paragraph (a) of this section if you certify without using ABT for that pollutant; or the FEL for that pollutant if you certify using ABT.

M = The NTE multiplier for that pollutant, as defined in paragraphs (c) through (e) of this section.

(c) For engines equipped with a catalyst, use NTE multipliers from the following table across the applicable zone specified in § 1045.515:

TABLE 1 TO § 1045.107—NTE MULTIPLIERS FOR CATALYST-EQUIPPED ENGINES

Pollutant	Subzone 1	Subzone 2
HC+NO <sub>x</sub> .....	1.50	1.00
CO .....	N/A	1.00

(d) For two-stroke engines not equipped with a catalyst, use an NTE multiplier of 1.2 for HC+NO<sub>x</sub> and CO. Compare the weighted value specified in § 1045.515(c)(5) to the NTE standards specified in paragraph (b) of this section.

(e) For engines not covered by paragraphs (c) and (d) of this section, use the NTE multipliers from the following table across the applicable zone specified in § 1045.515:

TABLE 2 TO § 1045.107—NTE MULTIPLIERS FOR FOUR-STROKE ENGINES WITHOUT CATALYSTS

Pollutant	Subzone 1	Subzone 2
HC+NO <sub>x</sub> .....	1.40	1.60
CO .....	1.50	1.50

### § 1045.110 How must my engines diagnose malfunctions?

The following engine-diagnostic requirements apply for engines equipped with three-way catalysts and closed-loop control of air-fuel ratios:

(a) *Equip your engines with a diagnostic system.* Equip each engine with a diagnostic system that will detect significant malfunctions in its emission control system using one of the following protocols:

(1) If your emission control strategy depends on maintaining air-fuel ratios at stoichiometry, an acceptable diagnostic design would identify a malfunction whenever the air-fuel ratio does not cross stoichiometry for one minute of intended closed-loop operation. You may use other diagnostic strategies if we approve them in advance.

(2) If the protocol described in paragraph (a)(1) of this section does not apply to your engine, you must use an alternative approach that we approve in advance. Your alternative approach must generally detect when the emission control system is not functioning properly.

(3) Diagnostic systems approved by the California Air Resources Board for use with sterndrive/inboard engines